DYNAMICS OF GEARS, FLEETS, CATCH AND FISHING SEASON OF SMALL-SCALE TUNA FISHERIES IN LABUHAN LOMBOK, WEST NUSA TENGGARA

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Received; Mei 07-2013 Received in revised from November 28-2015; Accepted December 02-2015
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ABSTRACT

In Indonesia, about 80% of fishing activities are small-scale and play major role both economically and socially. Previous studies mostly concentrated in Java, while in eastern part of Indonesia the information still scarce and limited. The study was conducted from January to December 2013, describes in detail the gears, fleets and catch dynamics of the small-scale tuna fisheries operating based in Labuhan Lombok Coastal Fishing Port (PPP. Labuhan Lombok). Small-scale tuna fishery in Labuhan Lombok are characterized by the small boats less than 10 GT, operating both troll line and hand line simultaneously, targeting large tuna, skipjack tuna and small tuna. Fishing season starts from April to August and influence by southwest monsoon wind and the presence of middleman as the connector between fishers and the market are the main character of the small-scale fisheries business in this area.

KEYWORDS: Small-scale tuna fisheries, fishing gears, fishing season, Labuhan Lombok

INTRODUCTION

A universal definition for small-scale fisheries is not available, largely because of their complexity (Chuenpagdee *et al*., 2006), but common criteria (SEAFDEC, 2003) include: 1) operated and funded by local fishermen, 2) a predominance of small vessels (often <10 GT), 3) a predominance of traditional fishing gears (but may include trawl, seine, gill-net, and longline vessels), 4) fishing trips are generally short (1-14 days) and inshore (within the Indonesian Exclusive Economic Zones) and 5) some of the fisheries are subsistence fisheries, but most are commercial nowadays.

Small-scale fisheries, especially in tropical coastal waters are characterized by great spatio-temporal variation, high diversity of gears and target species, wide dispersal of fishing activities along the coast, and uncertainty of landings (Oostenbrugge *et al*., 2002). In Indonesia, about 80% of fishing activities are small-scale (Mous *et al*., 2005) with various type of fishing gears (from traditional to modern technology) are used to exploit the fish resources (Sumiono, 1997). Regarding of its importance both economically and socially (Nikijuluw, 2002 *after* Wiyono *et al*., 2006), they are still poorly understood.

Nusa Tenggara Barat is one of the examples for small-scale tuna fisheries in Indonesia. Its fleet is dominated by outboard motor (53.4%), non-powered boat (29.6%) and inboard motor < 5 GT (8.2%). Large pelagic fishes contributed up to 139,890 t during 2003 – 2008 and the fisheries can lead to estimated production value up to IDR 1.5 trillion (DGCF, 2011). This number could not be ignored as it contributed a significant amount of earning to the society.

Several studies of small scale tuna fisheries in Indonesia have been conducted i.e. Nurdin & Nugraha (2007) which focused on tuna hand line fisheries in Prigi, East Java, Faizah & Aisyah (2011) in Sendang Biru, East Java, and Sulistyaningsih *et al.* (2011) in Kedonganan Bali. Nurdin (2008) described small scale tuna fishery in Prigi, Trenggalek, East Java, while Muhammad & Barata (2012) reported the size structure of hand line catch around fish aggregating device (FADs) in south of Bali and Lombok. However, most of the previous studies were concentrated in Java and Bali, while the in Nusa Tenggara has not been fully described especially the structure and characterization of small-scale tuna fisheries in Labuhan Lombok, Nusa Tenggara Barat. The purpose of this study are to provide the dynamics of gears, fleets, catches and fishing season of small-scale tuna fisheries operating based in Labuhan Lombok, Nusa Tenggara Barat. Socio-economics perspective also added to the discussion.

MATERIALS AND METHODS

Study area

PPP. Labuhan Lombok Coastal Fishing Port is located at 08º 29' 30" S dan 116º 38' 35" E on the eastern coast of Lombok Island. The site was chosen because it is one representative of the Eastern Indonesia small-scale tuna fisheries. Labuhan Lombok is one of the biggest landing ports in East Lombok beside Tanjung Luar, and become one of the proposed locations for Tuna Revitalization Program in Nusa Tenggara Barat.

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Small scale fisheries characteristics are multi-gear and multi-species. In general, similar size fishing vessels operate various types of fishing gear on the same fishing grounds i.e. south of Lombok Island and Sumbawa Island, stretched from 9 – 12° S and 116 – 120° E (Figure 1). Fishing vessels with gross tonnage (GT) < 10 are dominant used in this area with two major fishing gears used, i.e. troll line and hand line (with various modification on the design, hooks and baits).

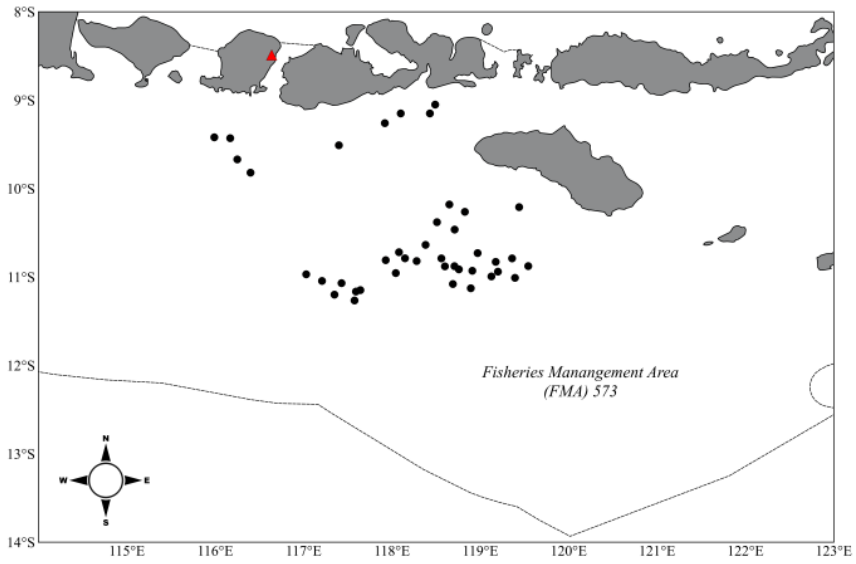


Figure 1. Known FADs of the small scale tuna fisheries based in PPP. Labuhan Lombok (actual FADs presumably higher).

Sources of data and pre-processing

Daily records from the local fisheries auction center of PPP. Labuhan Lombok from January to December 2013 provided a time series of small scale tuna commercial fishing data. Information on type and number of fishing gear (unit), number of fishing trip (trip year^{-1}), and total weight (kg) of catches by species. This paper does not separate catch between troll line and hand line since both are used simultaneously during operation and the landing data were absent of information about catch per gear.

The statistical data provided by PPP. Labuhan Lombok covered Fisheries Management Area 573 (Indian Ocean) and 713 (North of Nusa Tenggara and Banda Sea), prior to 2011. The data used for the analysis in this paper was restricted only from Indian Ocean (FMA 573) and limited to the fishes belong to the group of large tuna i.e. yellowfin tuna (*Thunnus albacares*), bigeye tuna (*Thunnus obesus*) and albacore (*Thunnus alalunga*); small tuna i.e. kawakawa (*Euthynnus affinis*) and longtail tuna (*Thunnus tonggol*); and skipjack tuna (*Katsuwonus pelamis*). Statistical data from processing plant (UD) Baura and local authorities also obtained (Dept. for the Supervision of Fishing Vessels/WASKI, Labuhan Lombok Coastal Fishing Port, and Harbormaster) as comparisons.

Seasonal Fishing Index (SFI)

Information on seasonal catch was gained by finding the average monthly data (production & effort) altogether of tuna (yellowfin & bigeye tuna), skipjack and kawakawa from 2002 to 2012. Highest value occurred was placed as a base for assumption for seasonal catch (Merta *et al.,* 2004), following this equation:

$$SFI = \frac{Average\ monthly\ production}{Average\ monthly\ production\ in\ general}$$

Where:
SFI was Seasonal Fishing Index;

RESULTS AND DISCUSSION

Results

Development of fleets and fishing gears

Based on the fish carrier license (SIKPI) issued by transportation office (Dinas Perhubungan) there were only two type of vessels used in daily fishing operation, carrier vessel and the other is catcher/ troll line vessel (Figure 2). Both of them were under 10 GT, mostly between 3 – 4 GT (Table 1). Based on statistical data provided by PPP. Labuhan Lombok in 2011 there were 249 vessels registered, 16 enlisted as carrier vessel while the rest (233 units) were troll line vessels. The number of recorded landing vessel

from 2008 – 2012 relatively stable, but in 2012 was rapidly decline (Table 2). The number fishing gear used between 2010 to 2012 also tend to decline during that period of the years.

Carrier vessel does not equipped with fishing gears, it only collect fishes from local fishermen around the island, while troll line vessel equipped with troll line and hand line (multigears). Troll line and or hand line operation vessels rely on shallow water FAD, using 2 x 2 x 1 m Styrofoam as a buoy which attached to 20 – 30 pieces of concrete as sinkers and utilizing coconut leaves as attractor (Appendix 1).

Table 1. Detail specification of troll line and hand line vessels (source: PPP. Labuhan Lombok)

Details	Specification
Materials	Wood
Length (m)	12 – 13.5
Width (m)	2.5
Depth (m)	1
Tonnage (GT)	3 – 4
Capacity (ton)	5
Crew	4 – 6
Trip (days)	5 – 20

Table 2. The number of recorded landing vessel from 2008 – 2012 (source: PPP. Labuhan Lombok)

Gross Tonnage	Year				
	2008	2009	2010	2011	2012
Up to 5 GT	1,317	776	983	827	414
> 5 – 10 GT	1,242	1,843	1,768	1,749	1,047
> 10 – 20 GT	-	-	-	-	-
> 20 – 30 GT	36	5	-	-	-

Figure 2. Carrier vessel (left) and catcher/ troll line vessel (right).

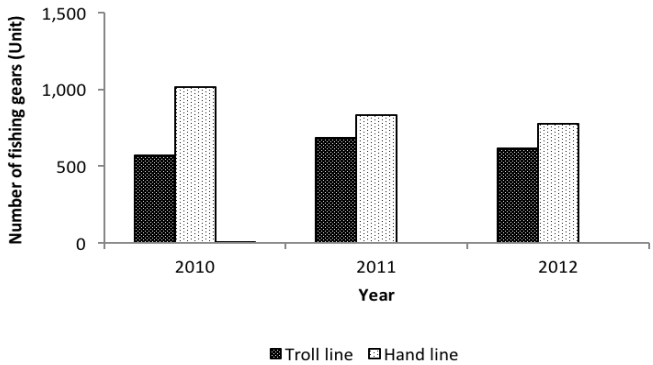


Figure 3. The development of fishing gears from 2010 – 2012 (source: PPP. Labuhan Lombok).

Catches development

During the period of this study, about 11 fish species were landed in PPP. Labuhan Lombok from troll line operation (with troll line and hand line gears), six of which are considered important: yellowfin tuna (*Thunnus albacares*), bigeye tuna (*Thunnus obesus*), albacore (*Thunnus alalunga*), kawakawa (*Euthynnus affinis*), longtail tuna (*Thunnus tonggol*), and skipjack (*Katsuwonus pelamis*) while the others like blue marlin (*Makaira nigricans*), black marlin (*Istiompax indica*), dolphinfish (*Corryphaea hippurus*) narrow-barred spanish mackerel (*Scromberomorus commerson*) and rainbow runner (*Elagatis bipinnulata*). Catch composition during January and December 2013 were dominated by yellowfin tuna (43.98%) and skipjack (28.76%) (Figure 7). Skipjack reached its peak on 2006 and declining afterward, adversely with yellowfin tuna, which progressing over years, while kawakawa relatively stable (Figure 8). Production of yellowfin tuna, skipjack and kawakawa are directly proportional with the number of the trip (Figure 9), it mean that almost all of the fleets are targeting for these commodities, while the other fishes listed i.e. dolphinfish, narrow-barred Spanish mackerel, billfishes etc. came as either by-catch or from carrier boat from local fishermen around the island using seine net.

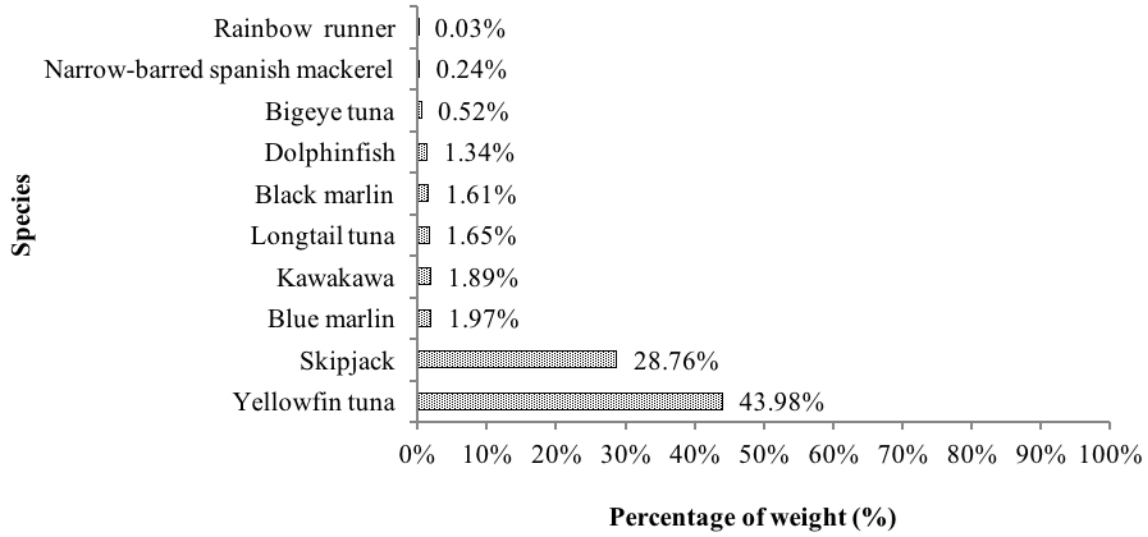


Figure 7. The average catches composition of troll line and or hand line from January to December 2013.

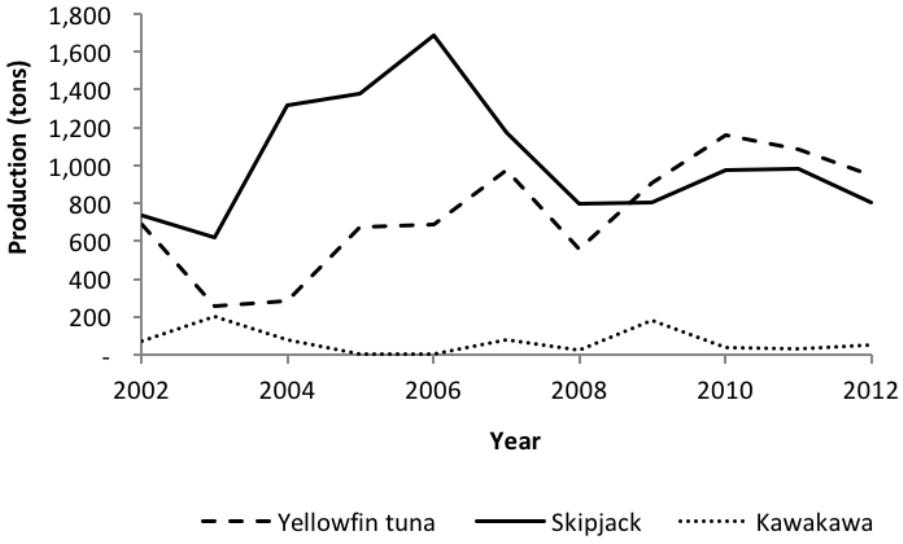


Figure 8. Annual production of yellowfin tuna, skipjack and kawakawa from PPP. Labuhan Lombok between 2002 and 2012.

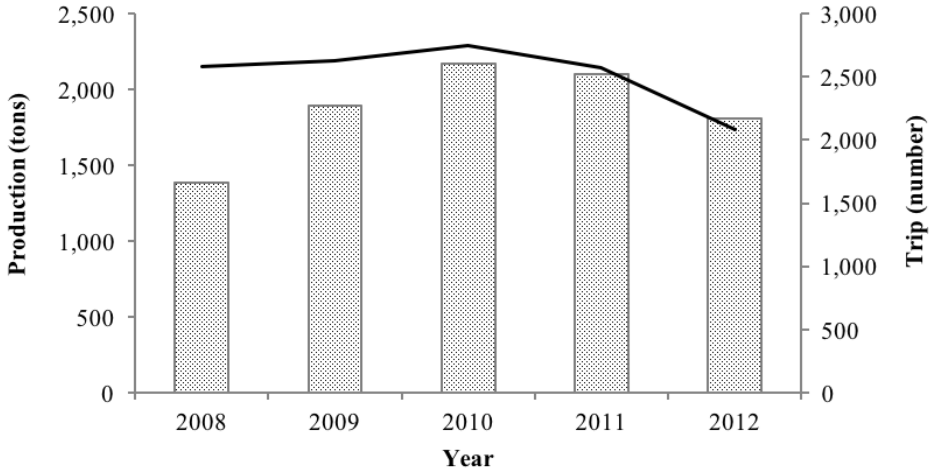
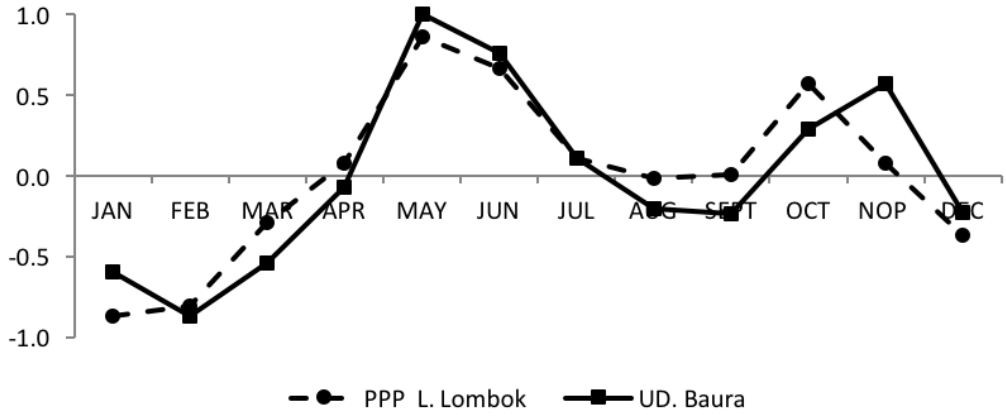


Figure 9. Comparisons of total catch per annum of yellowfin tuna, skipjack and kawakawa against fishing trip between 2008 and 2012 in PPP. Labuhan Lombok.

Seasonal Fishing Index (SFI)

Fishing season of tuna, skipjack, and other tuna were varied throughout the year. It reached the lowest in January (-0.87) and peaked in May (0.86) while October (0.57) was the second coming of the year. An interesting plot turned up when plotting seasonal fishing index (SFI) data from PPP. Labuhan Lombok with UD. Baura, the biggest processing plant in the region, from the plot it could be informed that both performed relatively similar pattern. Data from UD. Baura showed the catch landing reached its lowest in February (-0.9), first peak in May (1.0), and second in November (0.6) (Figure 10).



Gambar 10. SFI comparisons among tunas, skipjack and kawakawa from PPP. Labuhan Lombok and UD. Baura during 2008 to 2012.

Socio-economic perspective

Based on interview conducted during study, most of the fishermen based on PPP. Labuhan Lombok were come from Sulawesi, while only few were locals. Since small-scale fleets have many limitation (fuel, supplies and ice), the fishing has to be effective. Fishing by circling around FADs at dawn or dusk were the most common and effective way. One FAD belongs to one skipper and can be utilized up to 4 boats. The price for a single FAD around 30 – 50 million/unit, depends on the length of the rope sustain it. The operational cost for each trip (14 days in average) was around 7.5 million/trip/boat.

Most of the skippers “worked” for two biggest processing plants in Lombok Timur which is Baura and Versace, while others worked for smaller groups or individuals. There were 469 vessels under the management of Baura, while Versace around 40 – 50 vessels. The average production of Baura around 5 tons/day which could reach up to 200 tons/month during fishing season on April – June. The products were sent to bigger processing plant in Bali and

cannery in Pengambengan, Muncar, Surabaya, Gresik and Jakarta. Neither processing plants, groups or individuals are direct buyer, instead they are act like middlemen who are connecting between fishermen and the market.

Discussion

The catch of tuna in Labuhan Lombok is generated with non-motorized or outboard-powered vessels less than 10 GT, using troll line and hand line or similar non-industrial gears are what defined artisanal fisheries, especially in Indonesia as it reported by Proctor *et al*. (2003); Gillett (2011). Troll line rarely used to catch large tuna, instead they use it to catch bait fishes or small fishes for consumption. It usually operated at dawn or day. Hand line on the other hand are more favorable to catch large tuna because it can reach certain depth where tuna lies. Both of vessels operating and fishermen in Labuhan Lombok were from south of Sulawesi i.e. Polewali Mandar, Sinjai, Bone, & Majene, as they dominate almost all small scale tuna fishery in South of Java, Bali, and West Nusa Tenggara. Small-scale tuna fisheries in Labuhan Lombok as well as in Indonesia, usually associated with Fish Aggregation Device (FAD) targeting tuna, kawakawa, and skipjack (Monintja, 1993). The location of the FADs used by fishermen based in PPP. Labuhan Lombok spread from 10 – 12^{o} S to 109 – 112^{o} E (Alas Strait and in between southern and northern part of Lombok Island). FADs have been used traditionally in eastern Indonesia since 1980s (Nasution *et al*., 1986). Monintja & Mathews (1999) mentioned that tuna aggregation around FADs increased catchability by more than 40% compared to free swimming tuna. Despite of it advantages it is also responsible for low recruitment, and may affect tuna distribution and abundance in neighboring areas (Monintja & Mathews, 1999).

The large portion of yellowfin tuna, kawakawa, and skipjack caught (74.63% of total catch) mean that these species the main target for almost all fleets based in PPP. Labuhan Lombok. This group of species are usually associated with FADs (Jaquemet *et al.*, 2011; Dempster & Taquet, 2004; Yusfiandani *et al.*, 2010) and also become the main target of many small-scale tuna fisheries alongside Indian Ocean. The total catch of skipjack was higher than tuna in 2009 before they shifted place. The declining production of skipjack tuna since 2006 were allegedly due to localized overfishing. When the FADs were exploited continuously, a large number of skipjack tuna were caught until reached its peak in 2006. As the number of skipjack decreasing due to heavy exploitation, the void around FADs will be filled by juvenile yellowfin tuna which sharing the same ecosystem. While the skipjack tuna stock recovering, more yellowfin tuna were caught and surpassed the production of skipjack tuna on 2009 and afterward.

Fishing season in Labuhan Lombok start on April to August, resting for 2 months (due to some of the fishermen were back home celebrating Eid feast) and then start over until November. As in other parts of Indonesia, the fishing season in Labuhan Lombok is mostly determined by rainfall linked to the monsoon winds which affected to the SFI value. The wind blows from the southeast between March and September as temperature is declining and the level of chlorophyll-a is increasing, causing upwelling. Conversely, from October to February, when the wind blows from the southwest to northwest, sea temperature start to rise and chlorophyll-a start to decline (DGCF, 2011; Surinati, 2009; Wiyono *et al*., 2006). The same pattern is likely occurs in almost small-scale tuna fisheries alongside Indian Ocean, as reported in Kedonganan, Bali (Sulistyaningsih *et al.*, 2011); Sendang Biru, Malang (Nurdin *et al.*, 2008) and Prigi, East Java (Nurdin *et al.*, 2012). The west monsoon usually occurs from October to April and causes bad weather, marked by high intensity of rainfall and high tide. At this moment fishermen are reluctant to fishing, they prefer stay at home, fixing their gears and boats and using the leftover money to survive during the bad weather. This will lead to scarcity of fishes in the market, resulting in uprising price.

Small-scale tuna industry in the eastern part of Indonesia, especially in Labuhan Lombok is unique from one place to another, but they likely perform the same way of doing business. Since fishers are not equipped with appropriate financial capability, they often rely on the owner of the boat. While both of them are looking for better fishing ground which mean away from their neighborhood, injection of more financial capital is a necessity in order to survive. In this case the role of middleman or processing plant company is needed. Sometimes the boat owners have direct contact with the company, but in another case they need middleman before the company. This model creates an endless link of dependence and capital flow (Figure 11). Since the middleman/ company gives operational cost to the boat owners (FADs, boats, food supply, & fuel), priority of the fishes obtained must be sold back to the middleman/ company with “agreed price”. The biggest margin will always go to the middleman while the fishermen will always put in the difficult position since they do not have direct link to the market and financial resource.

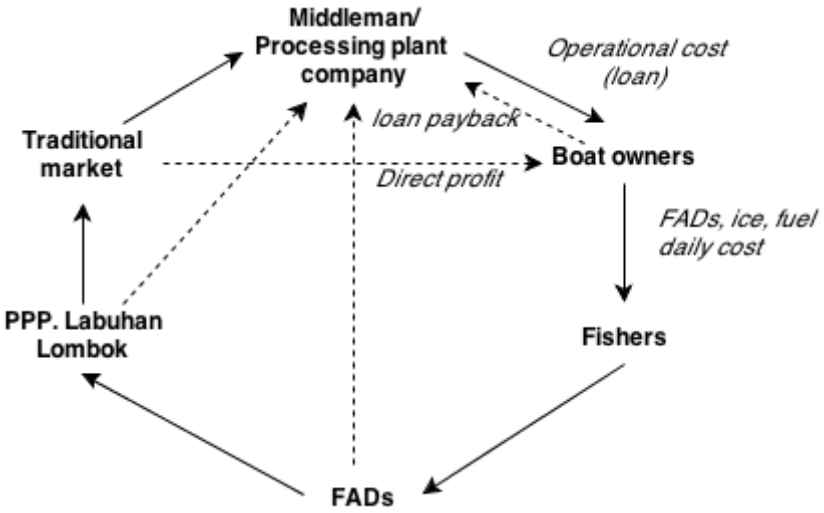


Figure 11. Capital flow of small-scale tuna fisheries in Labuhan Lombok.

The key solution to this matter is about how to cut the link between the middleman to the fishers, and given the fishers more direct access to market (processing plant) and financial funding (ease of credit from the bank). Forming the association among the fishermen as it happens in agricultural or manufacture industry, this will give them power to determine the way they doing business. The role of the government is necessity in making all of the solutions possible while the eagerness of the fishermen to change is always become the highest priority.

CONCLUSION

Structure of small scale tuna fishery in Labuhan Lombok are characterized by the small boats less than 10 GT, operating both troll line and hand line simultaneously, and targeting tuna and skipjack and also the presence of middleman as the connector between fishers and market.

ACKNOWLEDGEMENTS

This paper is authors' contribution to research on assessment of skipjack (*Katsuwonus pelamis*) fishing ground in the Indian Ocean south of Java, Bali, and Nusa Tenggara in 2012. The Authors would like to thank to UD. Baura, for their hospitality during the research, WASKI, Labuhan Lombok Coastal Fishing Port and Harbormaster for providing the data and also for the enumerator.

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Appendix 1. Detail construction of a FAD used by troll line and hand line fishermen in Labuhan Lombok, Nusa Tenggara Barat.